Williams®

16P-3001-101 R-T
April, 1981

DEFENDER



Williams® ELECTRONICS, INC.

3401 N. California Ave., Chicago, IL 60618
Cable Address: WILCOIN, CHICAGO
(312) 267-2240

For service call TOLL-FREE:
800-621-4765
In Illinois call
800-972-7898

SPECIAL NOTES

CPU/Video Board
Requires Decoder ROM 2 at location 3K and Decoder ROM 3 at location 3E.

Interface Board
Jumper W1 must be installed. If red-labeled ROMS are not used, W2 must be removed.

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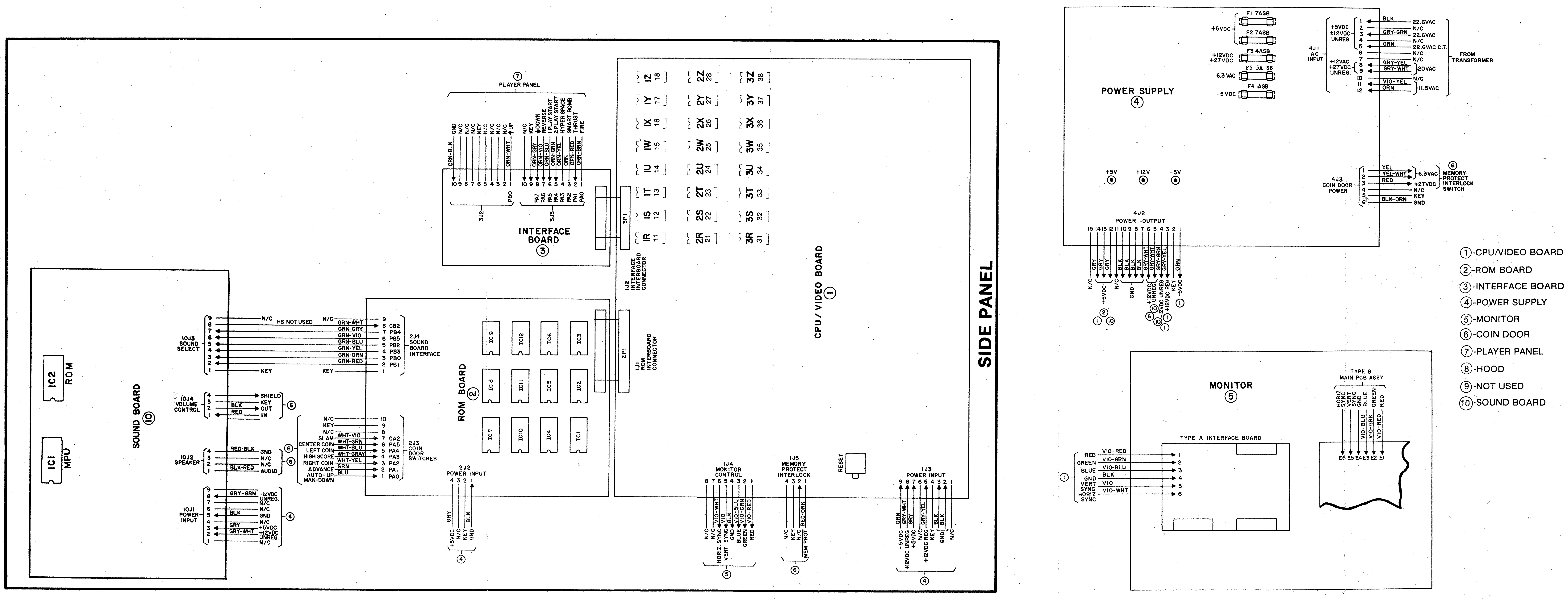
D8121 Sound Board Assembly Drawing 14

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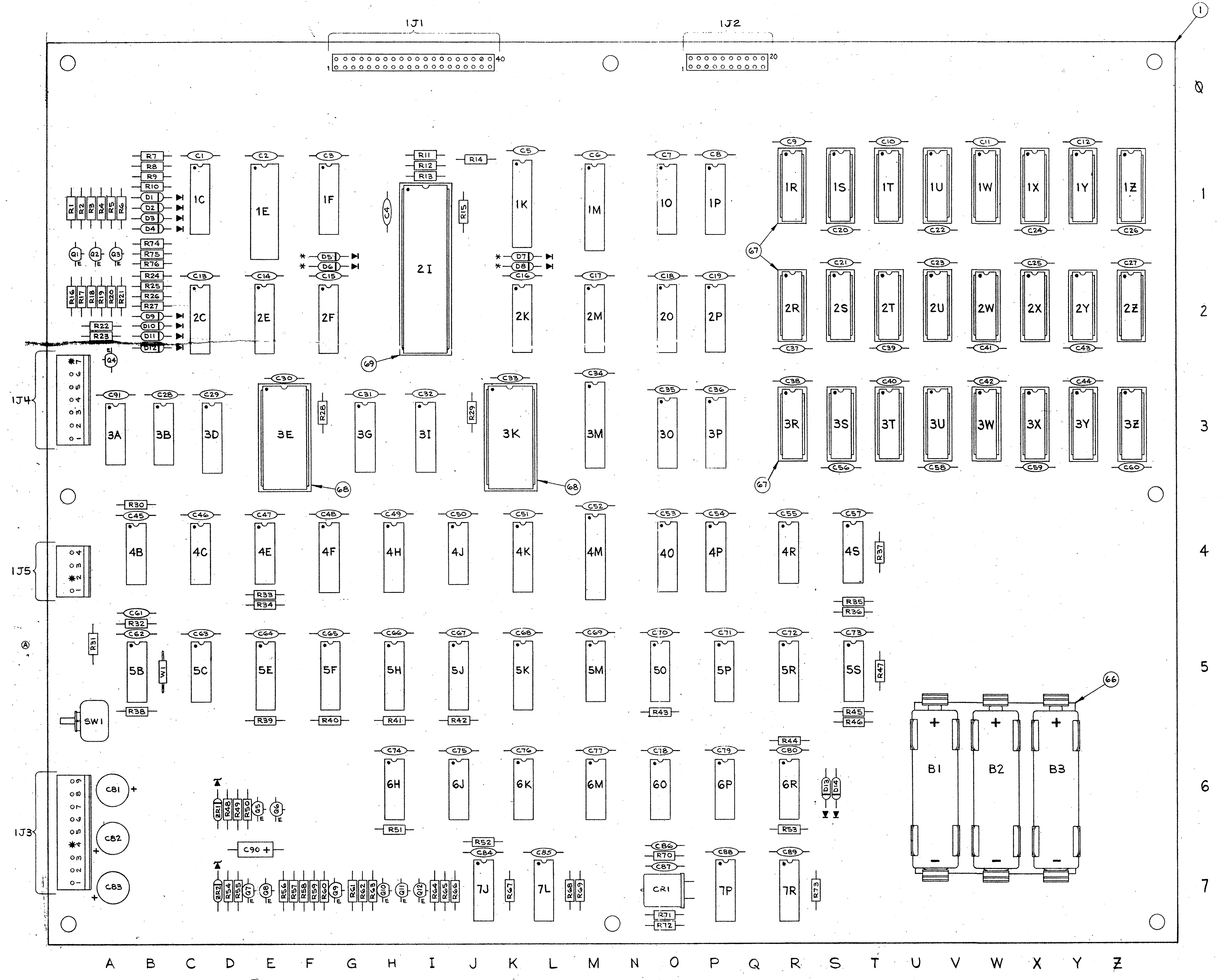
D8224 Sound Board Assembly Drawing 16

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Cabinet Wiring Diagram 18



Interboard Wiring Diagram



NOTES:

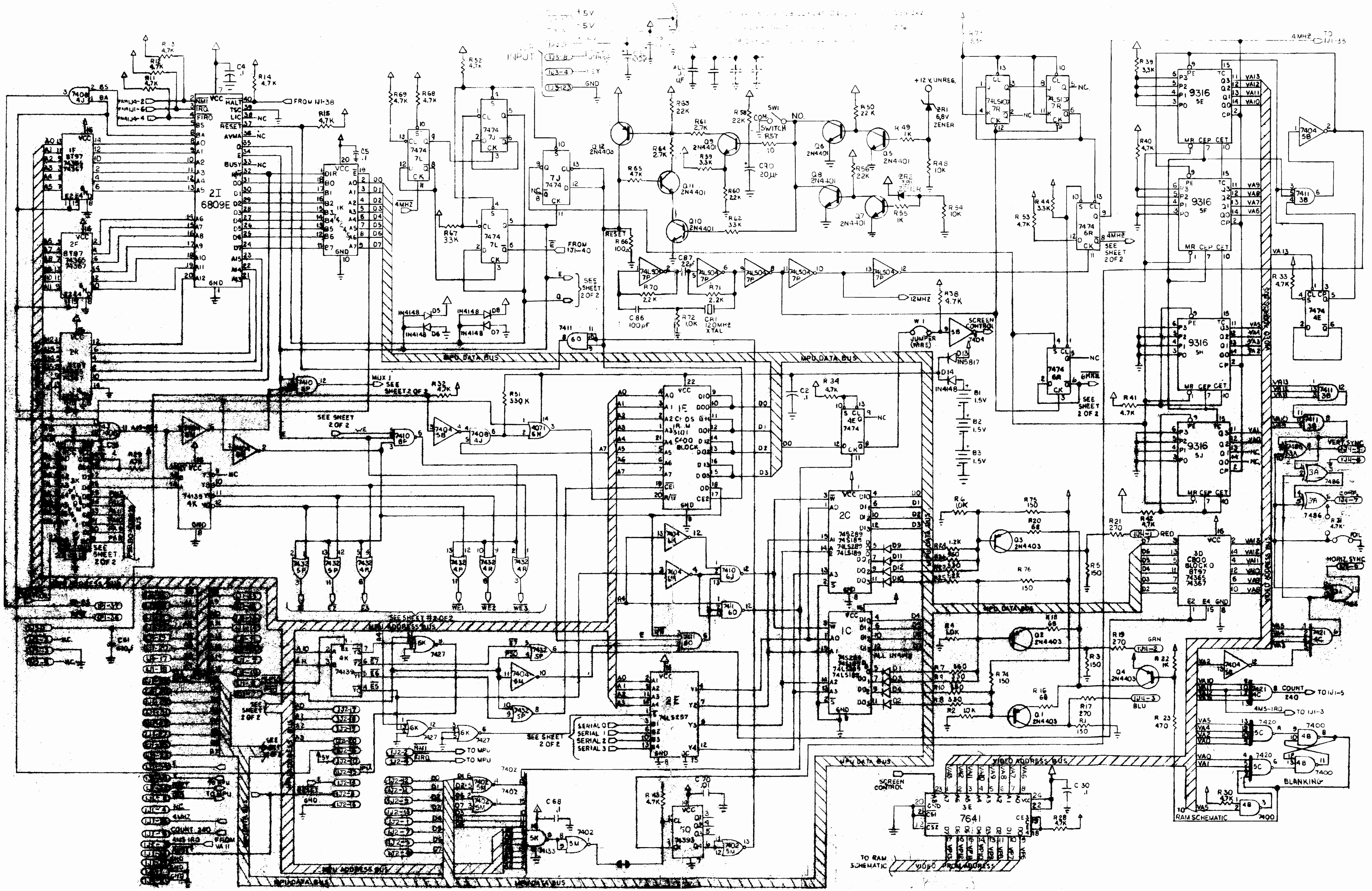
1. 4116: 1R, 1S, 1T, 1U, 1W, 1X, 1Y, 1Z, 2R, 2S, 2T, 2U, 2W, 2X, 2Y, 2Z, 3R, 3S, 3T, 3U, 3W, 3X, 3Y, 3Z
2. 4.7K RESISTOR: R11, R12, R13, R14, R15, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R40, R41, R42, R43, R45, R46, R47, R52, R53, R68, R69
3. .1 MFD. CAPACITOR: C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78 C79, C80, C84, C85, C88, C89, C91
4. IN4148 DIODE: D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D14
5. * - THESE COMPONENTS ARE NOT USED IN THIS GAME - DEFENDER.

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
76	5010-09508-00	R17, R19, R21	RESISTOR, C.F., 270 OHM 2% 1/4 W.	3
77	5010-09534-00	W1	RESISTOR, C.F., 0 OHM	1

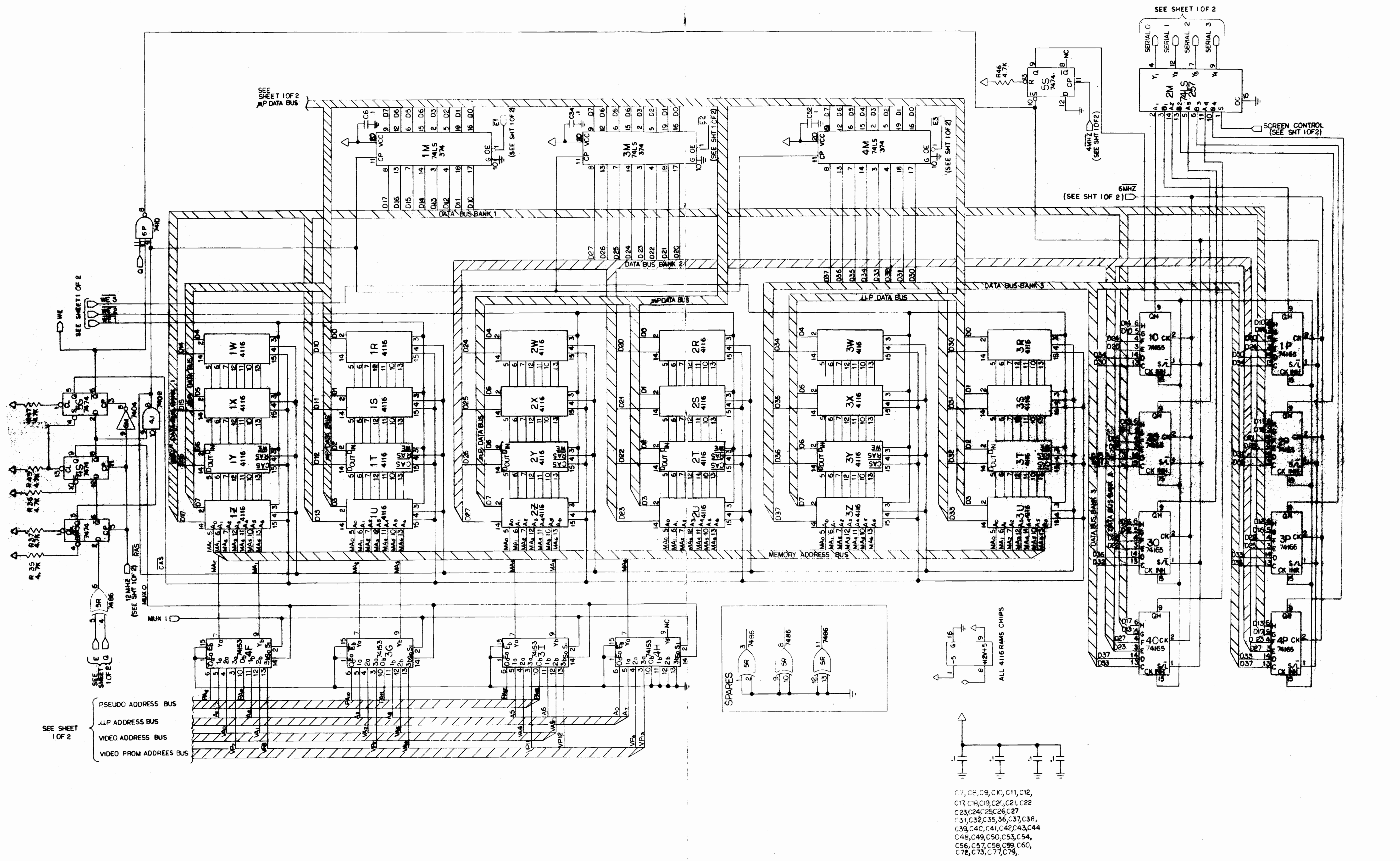
BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	5770-09616-00	—	BARE P.C. BOARD	1
2	5280-09073-00	4B	7400 QUAD 2-INPUT NAND	1
3	5280-08948-00	5M	7402 QUAD 2-INPUT NOR	1
4	5281-09215-00	7P	74LS04 HEX. INVERTER	1
5	5280-09013-00	5B, 6M	7404 HEX. INVERTER	2
6	5280-08973-00	4J	7408 QUAD AND	1
7	5280-09011-00	6J, 6P	7410 TRIPLE 3-INPUT NAND	2
8	5280-09475-00	3B, 6O	7411 TRIPLE 3-INPUT AND	2
9	5280-09530-00	5C	7420 DUAL 4-INPUT NAND	1
10	5280-09476-00	4C	7421 DUAL 4-INPUT AND	1
11	5280 09477-00	4R, 5P	7432 QUAD 2-INPUT OR	2
12	5280-09478-00	4E, 6R, 7J, 7L	7474 DUAL-D TYPE FLIP-FLOP	4
13	5280-09479-00	3A, 5R	7486 QUAD 2-INPUT EX-OR	2
14	5281-09480-00	7R	74LS107 DUAL J-K FLIP-FLOP	1
15	5281-09532-00	5K	74LS133 13-INPUT NAND	1
16	5281-09246-00	4K	74LS139 DUAL 2 to 4 LINE DECODER	1
17	5280-09481-00	3G, 3I, 4F, 4H	74153 DUAL 4 to 1 DATA INVERT	4
18	5280-09482-00	1O, 2O, 3O, 4O, 1P, 2P, 3P, 4P	74165 8-BIT SHIFT REGISTER	8
19	5281-09483-00	1C, 2C	74LS89 or 74LS189 or 74LS289 16x4 RAM	2
20	5281-09308-00	1K	74LS245 OCTAL BUS TRANSCEIVER	1
21	5281-09485-00	2E, 2M	74LS257 QUAD DATA MULPX.	2
22	5370-08989-00	1F, 2F 2K, 3D	8T97 HEX. TS BUFFER	4
	5281-09385-00		74LS367 HEX BUS DRIVER	0
23	5281-09486-00	1M, 3M, 4M	74LS374 OCTAL D-TYPE FLIP-FLOP	3
24	5281-09487-00	4S, 5S	74LS74 DUAL D-TYPE FLIP-FLOP	2
25	5281-09533-00	5O	74LS393 DUAL 4-BIT BIN. COUNTER	1
26	5342-09015-00	3E, 3K	7641 512 x 8 PROM	2
27	5310-09237-00	6H	4071 CMOS QUAD 2-INPUT NOR	1
28	5340-09488-00	SEE NOTE *1	4116 (450 ns ACCESS) 16K x 1 DYNAMIC RAM	24
29	5340-09017-00	1E	5101 256 x 4 CMOS RAM	1
30	5280-09489-00	5E, 5F, 5H, 5J	9316 4-BIT BIN. COUNTER	4
31	5400-09490-00	2I	6809E MICROPROCESSOR	1
32	5280 09547-00	6K	7427 TRIPLE 3-INP. POS-NOR GATE	1
33	5010 09548-00	R16, R18, R20	RESISTOR, C.F. 68 OHM 2% 1/4 W.	3
34	5010-09036-00	R66	RESISTOR, C.F. 100 OHM 5% 1/4 W.	1
35	5010-09187-00	R1, R3, R5, R74, R75, R76	RESISTOR, C.F. 150 OHM 5% 1/4 W.	6
36	5010-09416-00	R23	RESISTOR, C.F. 470 OHM 5% 1/4 W.	1
37	5010-08992-00	R7, R10, R26	RESISTOR, C.F. 560 OHM 5% 1/4 W.	3
38	5010-09358-00	R2, R4, R6, R22, R49, R55, R72	RESISTOR, C.F. 1K OHM 5% 1/4 W.	7
39	5010-09314-00	R24, R25	RESISTOR, C.F. 1.2K OHM 5% 1/4 W.	2
40	5010-08998-00	R60, R70, R71	RESISTOR, C.F. 2.2K OHM 5% 1/4 W.	3
41	5010-08997-00	R61, R64	RESISTOR, C.F. 2.7K OHM 5% 1/4 W.	2
42	5010-08983-00	R39, R44, R59, R67, R73	RESISTOR, C.F. 3.3K OHM 5% 1/4 W.	5
43	5010-08991-00	SEE NOTE *2	RESISTOR, C.F. 4.7K OHM 5% 1/4 W.	27
44	5010-09034-00	R48, R54	RESISTOR, C.F. 10K OHM 5% 1/4 W.	2
45	5010-08774-00	R50, R56, R58, R63	RESISTOR, C.F. 22K OHM 5% 1/4 W.	4
46	5010-09113-00	R62	RESISTOR, C.F. 33K OHM 5% 1/4 W.	1
47	5010-09359-00	R65	RESISTOR, C.F. 47K OHM 5% 1/4 W.	1
48	5010-09442-00	R51	RESISTOR, C.F. 330K OHM 5% 1/4 W.	1
49	5010-09001-00	R8, R9, R27	RESISTOR, C.F. 330 OHM 5% 1/4 W.	3
50	5010-09039-00	R57	RESISTOR, C.F. 10 OHM 5% 1/4 W.	1
51	5043-09491-00	C87	CAPACITOR, AXIAL 22 PFD. 1K V. ±10%	1
52	5043-09492-00	C86	CAPACITOR, AXIAL 100 PFD. 50 V. ±10%	1
53	5040-09545-00	C90	CAPACITOR, AXIAL 22 MFD. 10 V. ±20%	1
54	5043-09065-00	C61	CAPACITOR, AXIAL 470 PFD. 50 V. X7R	1
55	5043-08996-00	SEE NOTE *3	CAPACITOR, AXIAL .1 MFD. 50 V. ±20%	84
56	5040-09421-00	C81, C82, C83	CAPACITOR, RADIAL 100 MFD. 25 V. +50 -10%	3
57	5075-09059-00	ZR2	IN5990A 3.9 V. ZENER DIODE	1
58	5075-09018-00	ZR1	IN5996A 6.8 V. ZENER DIODE	1
59	5070-08919-00	SEE NOTE *4	IN4148 DOIDE, SILICON	13
60	5070-09266-00	D13	IN5817 DOIDE, SILICON	1
61	5160-08938-00	Q5, Q6, Q7, Q8, Q9, Q10, Q11	2N4401, TO-92 TRANSISTOR, NPN	7
62	5190-09016-00	Q1, Q2, Q3, Q4, Q12	2N4403, TO-92 TRANSISTOR, PNP	5
63	5520-09495-00	CR1	12 MHZ CRYSTAL	1
64	5641-09371-00	SW1	PUSH BUTTON SW. DPST (MOMENTARY ON)	1
65	5880-09022-00	B1, B2, B3	BATTERY ALKALINE 1.5 V. (AA)	3
66	5881-09021-00	—	BATTERY HOLDER *171	1
67	5700-09006-00	—	16-PIN IC SOCKET	24
68	5700-09004-00	—	24-PIN IC SOCKET	2
69	5700-08985-00	—	40-PIN IC SOCKET	1
70	5791-09437-00	1P4	20 PIN RIBBON CABLE HEADER	1
71	5791-09349-00	1P1	40 PIN RIBBON CABLE HEADER	1
72				
73	5791 09028-00	1P5	4 PIN HEADER 09-65-1041	1
74	5791-09497-00	1P2	7 PIN HEADER 09-65-1071	1
75	5791-[illegible]-00	1P3	9 PIN HEADER 09-65-1091	1

R8570 CPU/Video Board Assembly Drawing

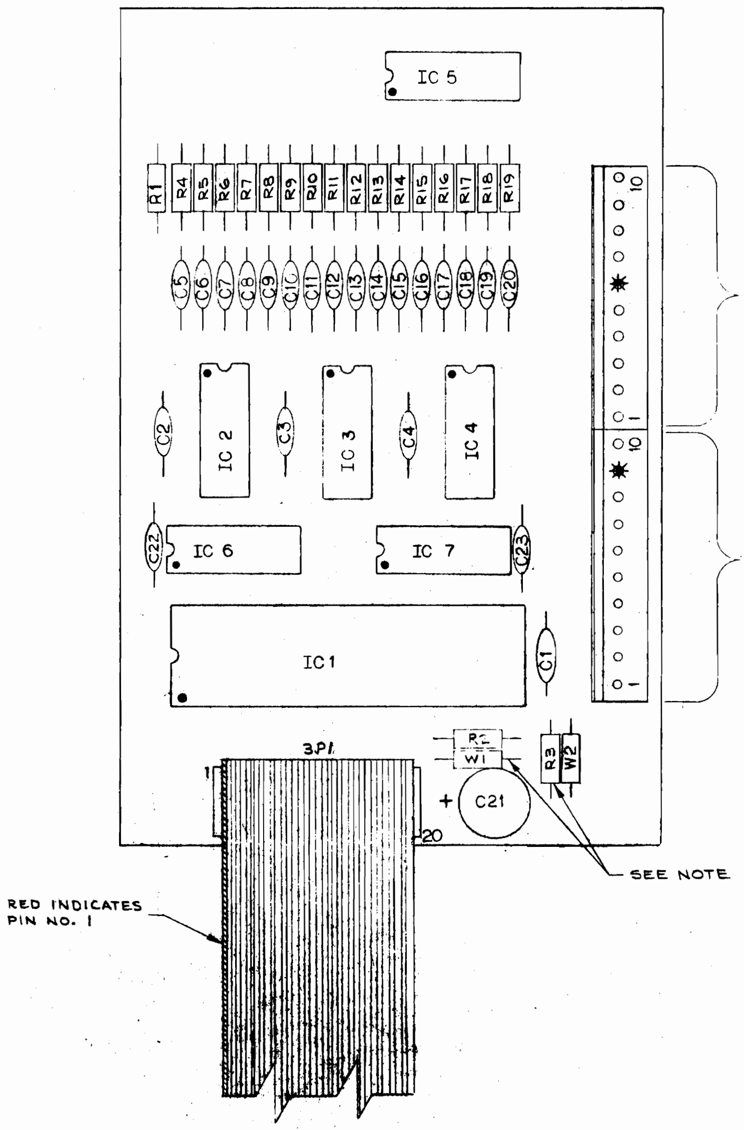


R8570 CPU/Video Board Logic Diagram
(Sheet 1 of 2)



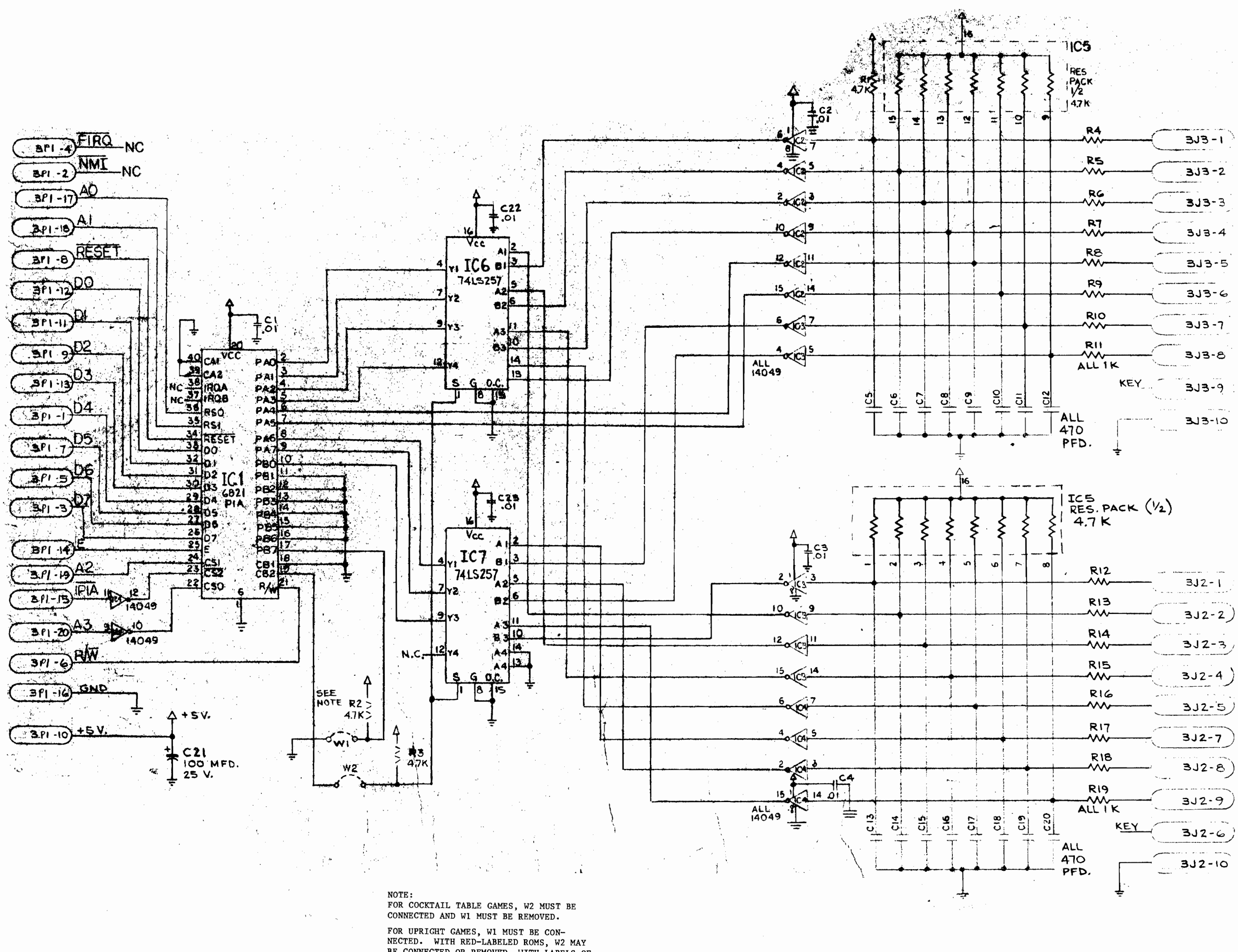
R8570 CPU/Video Board Logic Diagram
(Sheet 2 of 2)

BILL OF MATERIALS				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	NO REQ'D
1	5772-09614-00		BARE P.C. BOARD	1
2	5310-08975-00	IC2, IC3, IC4	4049 CMOS HEX INVERTER	3
3	5019-09239-00	IC5	4.7KΩ 15 RES 16 PIN DIP PACK	1
4	5281-09485-00	IC6, IC7	74LS257 QUAD DATA MULTIPLEXER	2
5	5010-08991-00	R1, R2, R3	RESISTOR, F.C., 4.7K OHM 5% 1/4 WATT	3
6	5010-09358-00	R4 THRU R19	RESISTOR, F.C., 1K OHM 5% 1/4 WATT	16
7	5043-09065-00	C5 THRU C20	CAPACITOR, CERAMIC DISC, 470 PFD. 50 V. X7R	16
8	5040-09421-00	C21	CAPACITOR, ELECTROLYTIC RAD., 100 MFD. 25 VOLT +50-10%	1
9	5043-08980-00	C1, C2, C3, C4, C22, C23	CAPACITOR, CERAMIC DISC, .01 MFD. 50 V. +80-20%	6
10	5791-09444-00	3J2, 3J3	10 PIN HEADER 09-65-1101	2
11	5795-09540-00	3P1	20 PIN RIBBON CABLE ASSY	1
12	5430-08972-00	IC1	6821 PIA	1
13	3610-09534-00	W1, W2	0 Ω RESISTOR	2



NOTE:
FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.

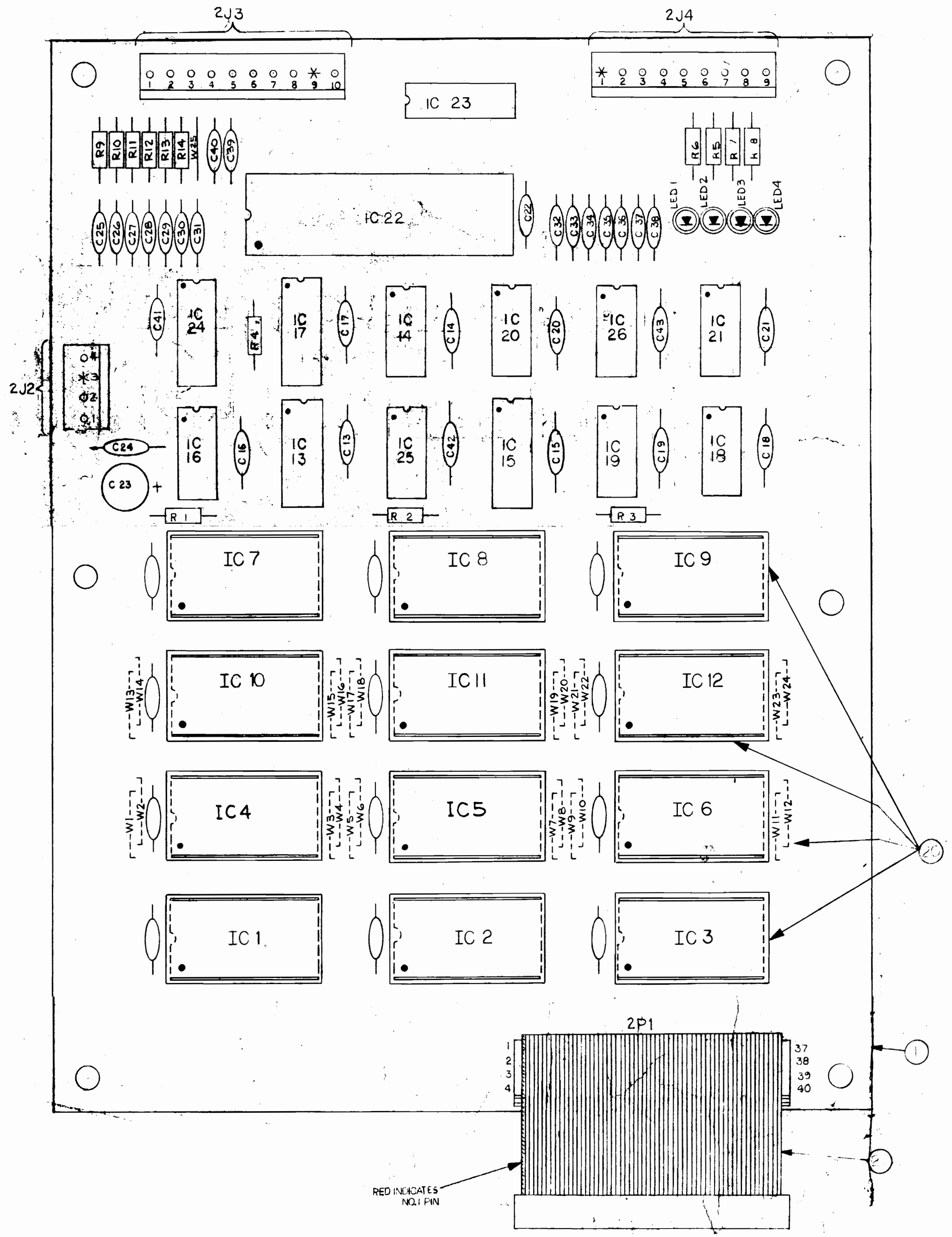
FOR UPRIGHT GAMES, W1 MUST BE CONNECTED. WITH RED-LABELED ROMS, W2 MAY BE CONNECTED OR REMOVED. WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.



NOTE:
FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.

FOR UPRIGHT GAMES, W1 MUST BE CONNECTED. WITH RED-LABELED ROMS, W2 MAY BE CONNECTED OR REMOVED. WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.

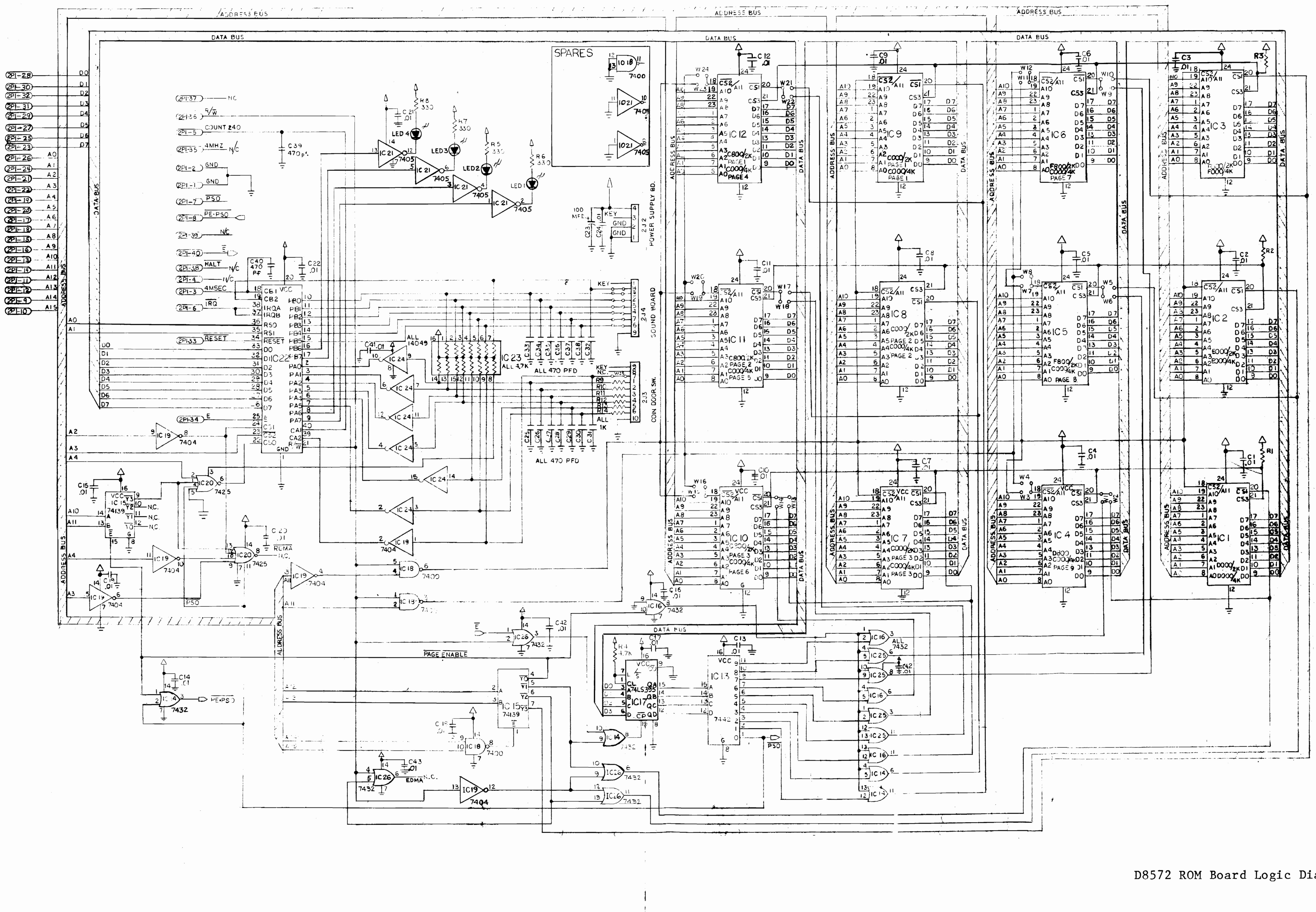
C8573 Interface Board Assembly and Logic Diagram



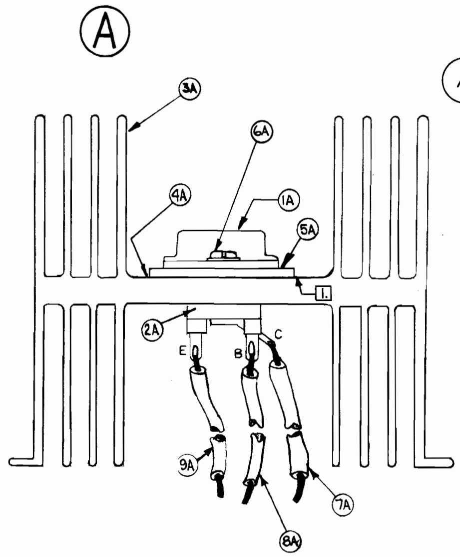
		BILL OF MATERIALS		
	PART NO.	PART DESIGNATION	DESCRIPTION	
1	5771-09615-00		BARE P.C. BOARD	
2	5280-09012-00	IC 13	7442 BCD DECODER	
3	5280-08477-00	IC14, IC16, IC25, IC26	7432 QUADRUPLE 2 INPUT [illegible]	
4	5281-09246-00	IC 15	74LS139 DUAL 2 TO 4 LINE DECODER	
5	5281-09501-00	IC17	74LS395 4-BIT UNIVERSAL SHIFT REG.	
6	5280-09073-00	IC18	7400 QUAD 2 INPUT NAND	
7	5280-09013-00	IC19	7404 HEX INVERTERS	
8	5280-09551-00	IC20	7425 DUAL 4 INPUT NOR GATES WITH STROBE	
9	5280-08999-00	IC 21	7405 HEX INVERTERS WITH OPEN-COLLECTOR OUTPUTS	
10	5430-08872-00	IC 22	MC 6821 PIA	
11	5019-09239-00	IC 23	4.7K 15 RES. 16 PIN DIP PACK	
12	5671-09019-00	LED1 THRU LED4	LED, RED	
13	5010-09001-00	R1 THRU R3 R5 THRU R8	RESISTOR, C.F. 330 OHM 5% 1/4 W	
14	5010-08991-00	R4	RESISTOR, C.F. 4.7K OHM 5% 1/4 W	
15				
16	5043-08980-00	C1 THRU C16, C18 THR C22, C41-C45	CAP. CERAMIC .01 MFD 50V [illegible]	
17	5040-09424-00	C 23	CAP. ELECT. 100 MFD 25V. RAD. [illegible]	
18	5043-08996-00	C 24	CAP. CERAMIC .1 MFD 50V [illegible]	
19	5043-09045-00	C17, C25 THRU C40	CAP. CERAMIC 470 PFD 50V AXIAL	
20	5700-09004-00		24 PIN IC SOCKET	
21	5795-09611-00	2P1	40 PIN RIBBON CABLE ASS'Y [illegible]	
22	5791-09028-00	2J2	4 PIN MALE CONNECTOR [illegible]	
23	[illegible]	2J3	10 PIN MALE CONNECTOR [illegible]	
24	[illegible]	2J4	[illegible]	
25	5310-08975-00	IC24	4049 INVERTING HEX. BU[illegible]	
26	5010-09358-00	R9 THRU R14	RESISTOR, C.F., 1K OHM 5% 1/4 W	
27	5010-09534-00	W1 THRU W25	RESISTOR, C.F., O OHM	AS REQ'D
28	SEE CHART	IC1 THRU IC12 SEE CHART	SEE CHART	AS REQ'D

	GAME NAME	"DEFENDER" RED LABEL				
	ASSEM. NO.	D-8572-3001				
PART DESIGNATION	IC1	A-5343-09636				PART NUMBER
	IC2	A-5343-09637				
	IC3	A-5343-09638				
	IC4	A-5343-09639				
	IC5	NOT USED				
	IC6	A-5343-09640				
	IC7	A-5343-09641				
	IC8	A-5343-09642				
	IC9	A-5343-09643				
	IC10	A-5343-09644				
	IC11	A-5343-09645				
	IC12	A-5343-09646				
	JUMPERS	W2, W4, W6, W7, W9, W11, W13, W16, W17, W20, W21, W24				

D8572 ROM Board Assembly Drawing



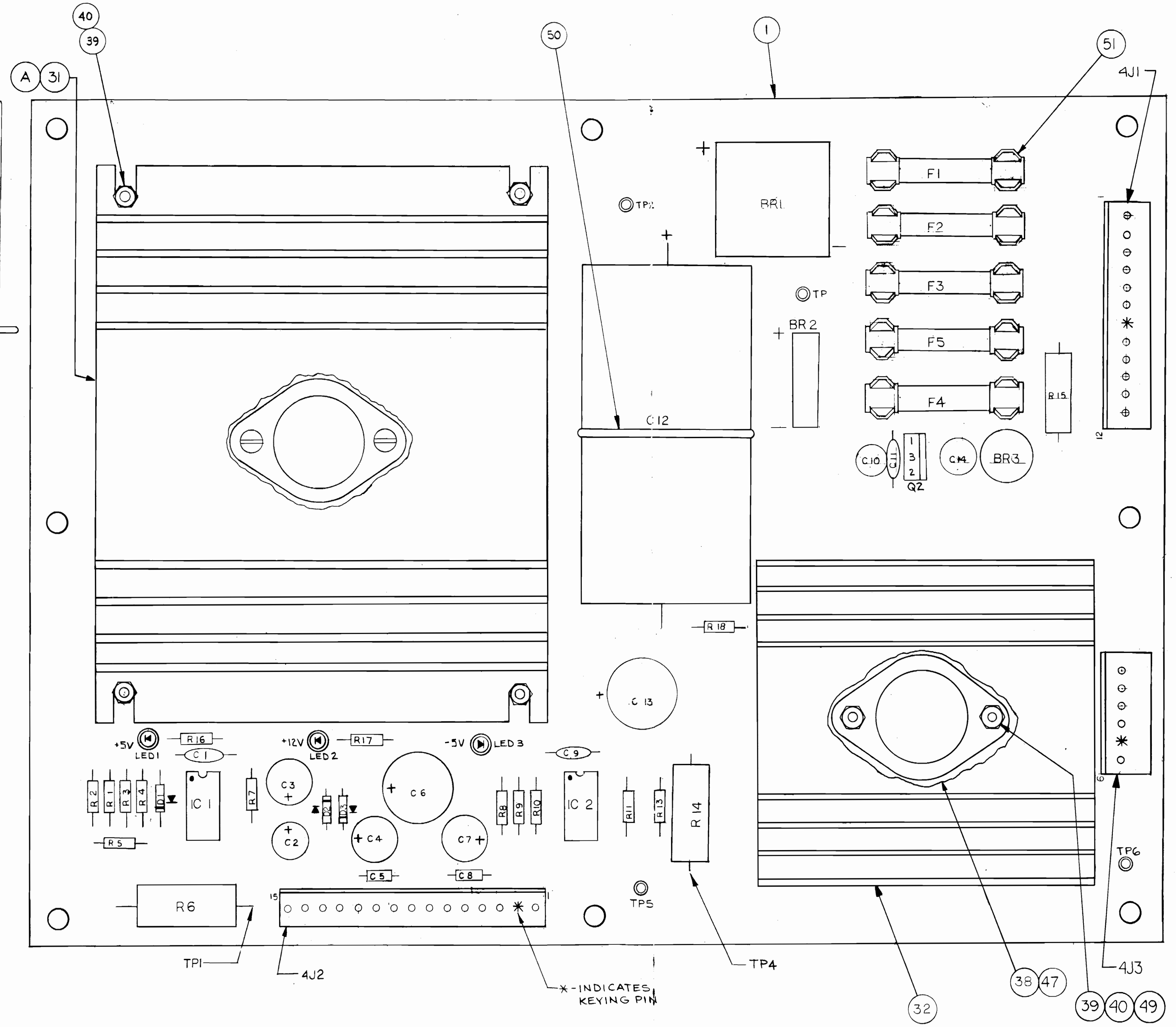
D8572 ROM Board Logic Diagram



ITEM NO	PART NO	DESCRIPTION	REQ'D NO.
1A	5162-09425 -00	TRANSISTOR NPN 2N6057	1
2A	5700-09445 -00	TRANSISTOR-SOCKET T03	1
3A	5705-09431 -00	HEAT SINK	1
4A	20-9229-00	THERMAL COMPOUND 1.5 OUNCE	1
5A	5701-09538 -00	T03 3 MIL MICA INSULATOR	1
6A	4006-01003 -8	MS-6-22x1/2-P-PH -S	2
7A	5853-09591 -00	LEAD WIRE #18 AWG 4" 3/8 STRIPPED (GRN)	1
8A	5853-09592 -00	LEAD WIRE #18 AWG-4" 3/8 STRIPPED (WHT)	1
9A	5853-09593 -00	LEAD WIRE #18 AWG-4" 3/8 STRIPPED (YEL)	1

BILL OF MATERIAL

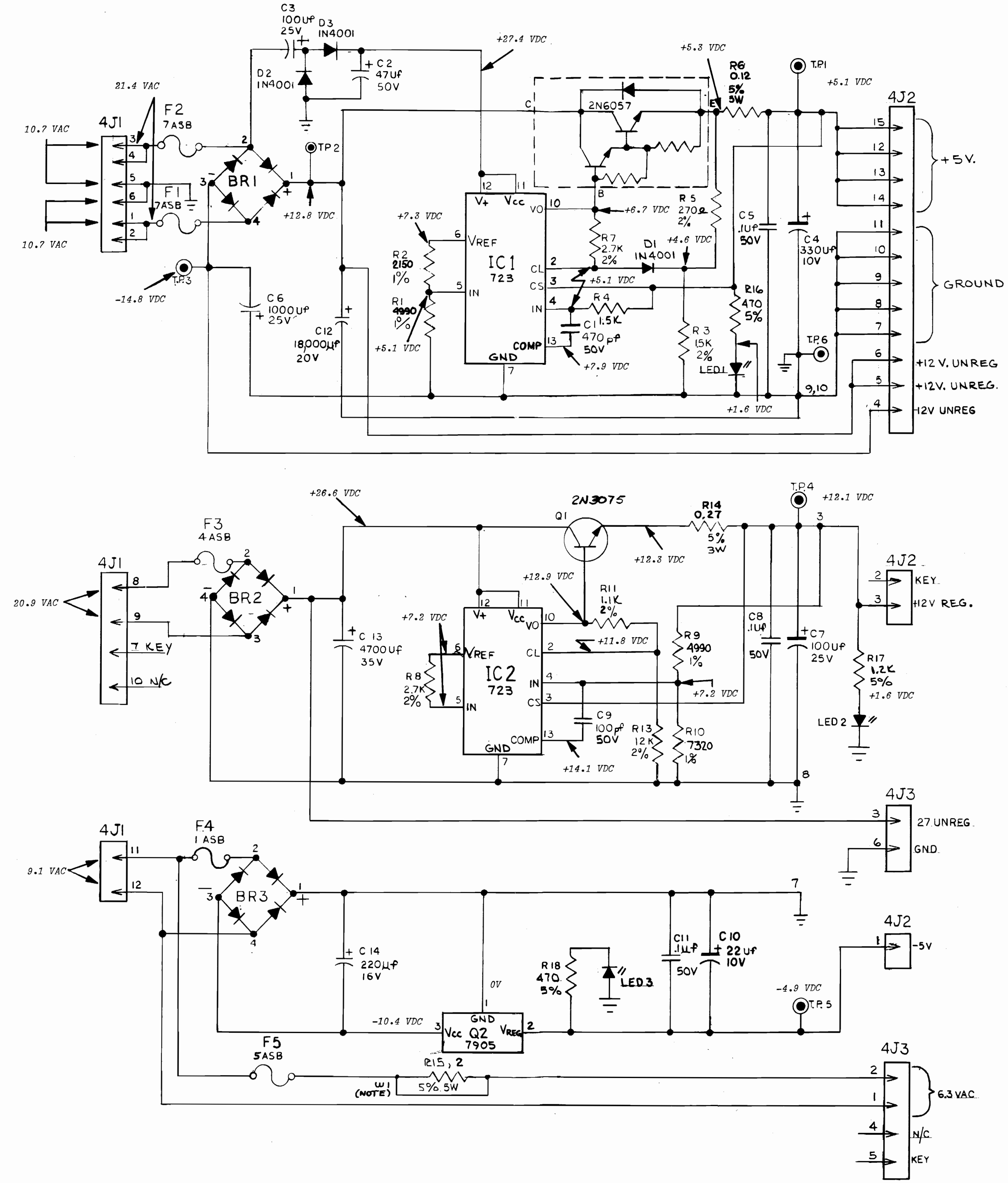
NOTES.
1. HEAT SINK COMPOUND MUST BE APPLIED BETWEEN MICA INSULATOR AND HEAT SINK AND BETWEEN MICA INSULATOR AND TRANSISTOR.



BILL OF MATERIAL

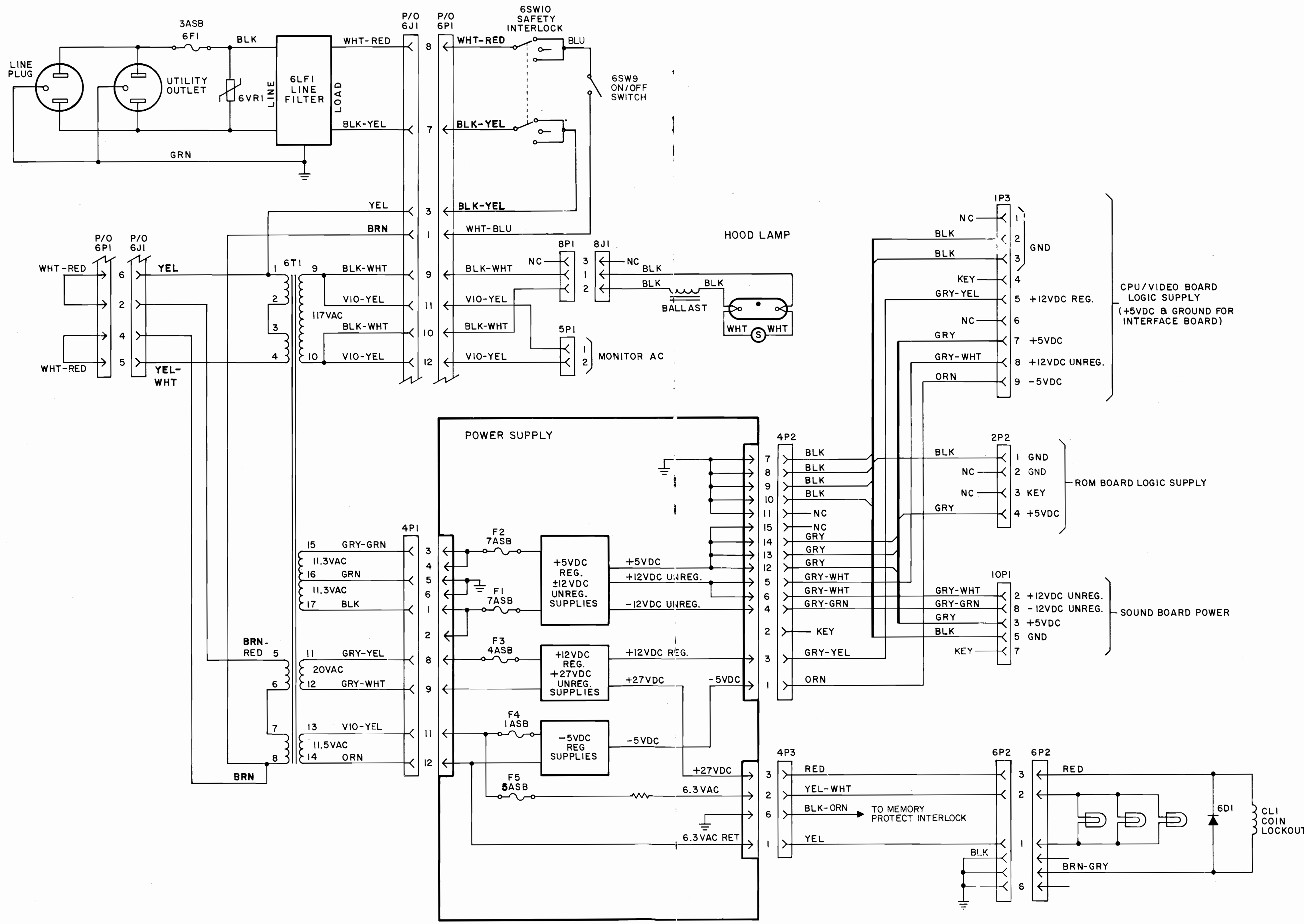
ITEM NO	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5773-09474-00		P.S. BARE P.C. BOARD	
2	5010-09085-00	R4	RESISTOR, 1.5K 5%, 1/4 W	1
3	5010-09541-00	R8, R7	RESISTOR, 2.7K 2%, 1/4W,	2
4	5010-09508-00	R5	RESISTOR, 270 2%, 1/4W	1
5	5010-09428-00	R3	RESISTOR, 1.5K 2%, 1/4W	1
6	5010-09509-00	R11	RESISTOR, 1.1K 2%, 1/4W	1
7	5010-09510-00	R13	RESISTOR, 12K 2%, 1/4W	1
8	5013-09542-00	R10	RESISTOR, 7.32 K 1%, 1/4W	1
9	5013-09427-00	R1 & R9	RESISTOR 4.99K 1% 1/4W	2
10	5013-09426-00	R2	RESISTOR 2.15K 1% 1/4 W	1
11	5012-08429-00	R6	RESISTOR 12Ω, 5%, 5W	1
12	5012-09512-00	R14	RESISTOR .27 5%, 5W	1
13	5040-09421-00	C3 & C7	+50% -10% CAPACITOR, 100MFD, 25V. RADIAL	2
14	5040-09422-00	C2	+50% -10% CAPACITOR, 47MFD, 50V RADIAL	1
15	5040-09420-00	C6	+50% -10% CAPACITOR, 1000 MFD, 25V. RADIAL	1
16	5040-09419-00	C12	+50% -10% CAPACITOR, 18,000MFD, 20V. RADIAL	1
17	5040-09423-00	C4	+50% -10% CAPACITOR, 330MFD, 10V. RADIAL	1
18	5040-09504-00	C13	+50% -10% CAPACITOR, 4700 MFD, 35V. RADIAL	1
19	5043-08996-00	C5, C8, C11	±20% CAPACITOR, .1 MFD, 50V. AXIAL Z5U	3
20	5043-09065-00	C1	±10% CAPACITOR, 470 PFD. 50V. AXIAL X7R	1
21	5043-09492-00	C9	±5% CAPACITOR, 100 PFD 50V. AXIAL S2L	1
22	5040-09506-00	C14	+50% -10% CAPACITOR, 220MFD, 16V. RADIAL	1
23	5040-09493-00	C10	+50% -10% CAPACITOR, 22MFD, 10V. RADIAL	1
24	5070-06258-00	D1, D2, D3	DIODE, IN4001	3
25	5100-09418-00	BR1	BRIDGE RECTIFIER 35AMP 100V	1
26	5100-09513-00	BR2	DIODE BRIDGE, 4.0A, 50V	1
27	5100-09514-00	BR3	DIODE BRIDGE 1.0A, 50V.	1
28	5731-09432-00	F1, F2	FUSE, 7A SB.	2
29	5731-06314-00	F3	FUSE, 4A, SB., 250 V.	1
30	5731-06569-00	F4	FUSE, 1A, SB	1
31	B-8416-00		HEAT SINK ASSEMBLY (SEE A)	1
32	5705-09543-00		HEAT SINK	1
33	5791-09074-00	4J2	HEADER, 15 PIN, 09-65-1151	1
34	5791-09043-00	4J1	HEADER, 12 PIN, 09-65-1121	1
35	5250-09515-00	Q2	VOLTAGE REGULATOR 7905	1
36	5460-09424-00	IC1, IC2	VOLTAGE REGULATOR 723	2
37	5824-09248-00	TP2, TP3, TP5, TP6	TERMINAL #1502-1 (TEST POST)	4
38	20-9229-00		THERMAL COMPOUND .02 OUNCE	AR
39	4005-01051-07		5-40x7/16 R.H. MECH. SCREW	6
40	4405-01117-00		5-40 HEX NUT	6
41	5161-09552-00	Q1	2N3055 TRANSISTOR NPN	1
42	5731-09651-00	F5	FUSE, 5A, SB	1
43	5791-09038-00	4J3	HEADER, 6 PIN, 09-65-1061	1
44	5012-09544-00	R15	RESISTOR, 2.0Ω, 5%, 5W	1
45	5010-09416-00	R16, R18	RESISTOR, 470Ω, 5%, 1/4W	2
46	5010-09314-00	R17	RESISTOR, 1.2K, 5%, 1/4 W	1
47	5701-09538-00		INSULATOR, MICA, 3mil	1
48	5671-09019-00	LED1, LED2, LED3	LED, RED	3
49	03-7598		INSULATOR, NYLON	2
50	03-7520		TIE WRAP	1
51	5732-09178-00		FUSEHOLDER	10

D8359 Power Supply Board Assembly Drawing

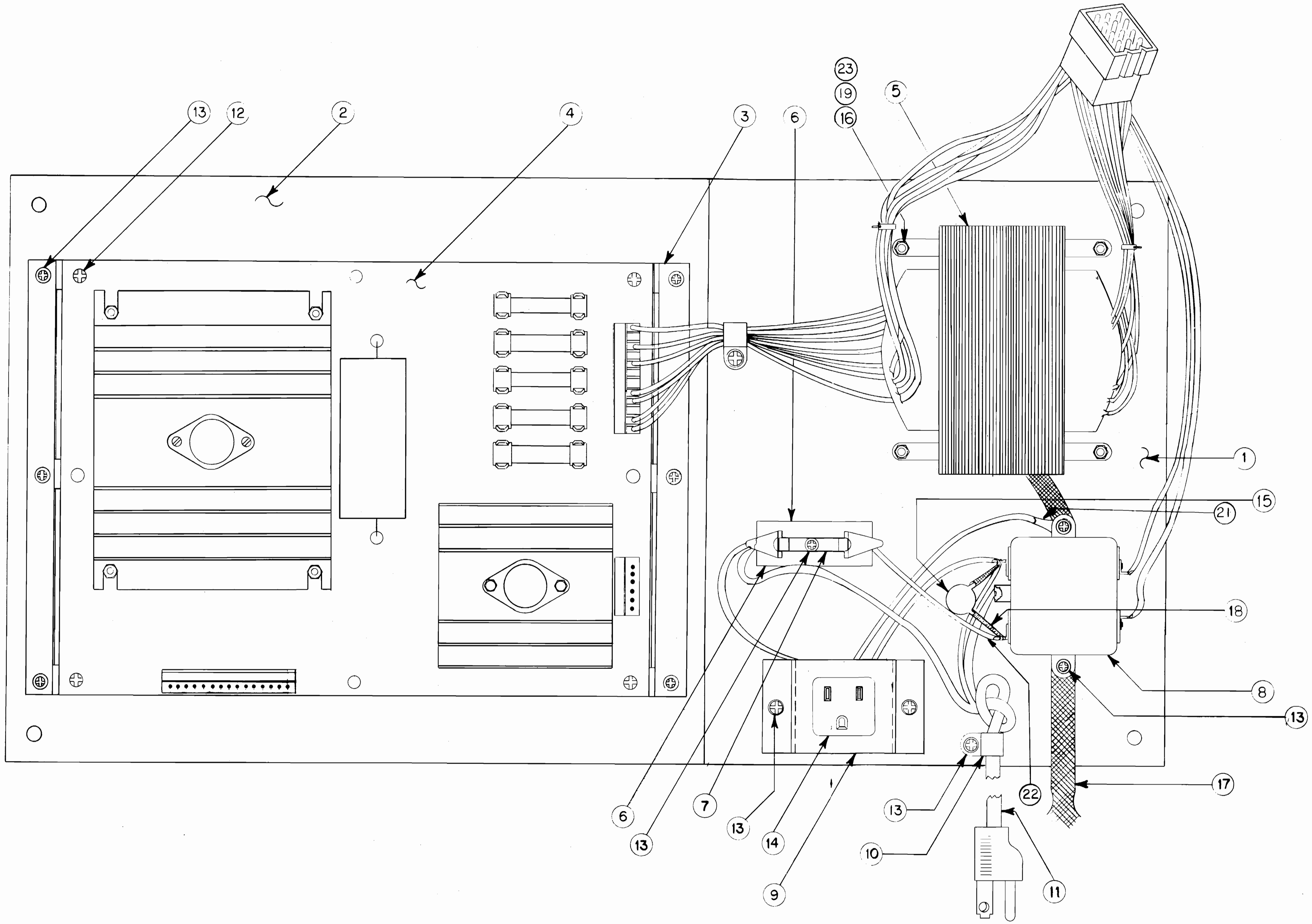


NOTE:
W1 CONNECTED ONLY FOR COCKTAIL APPLICATIONS.

D8359 Power Supply Board
Schematic Diagram



Power Wiring Diagram

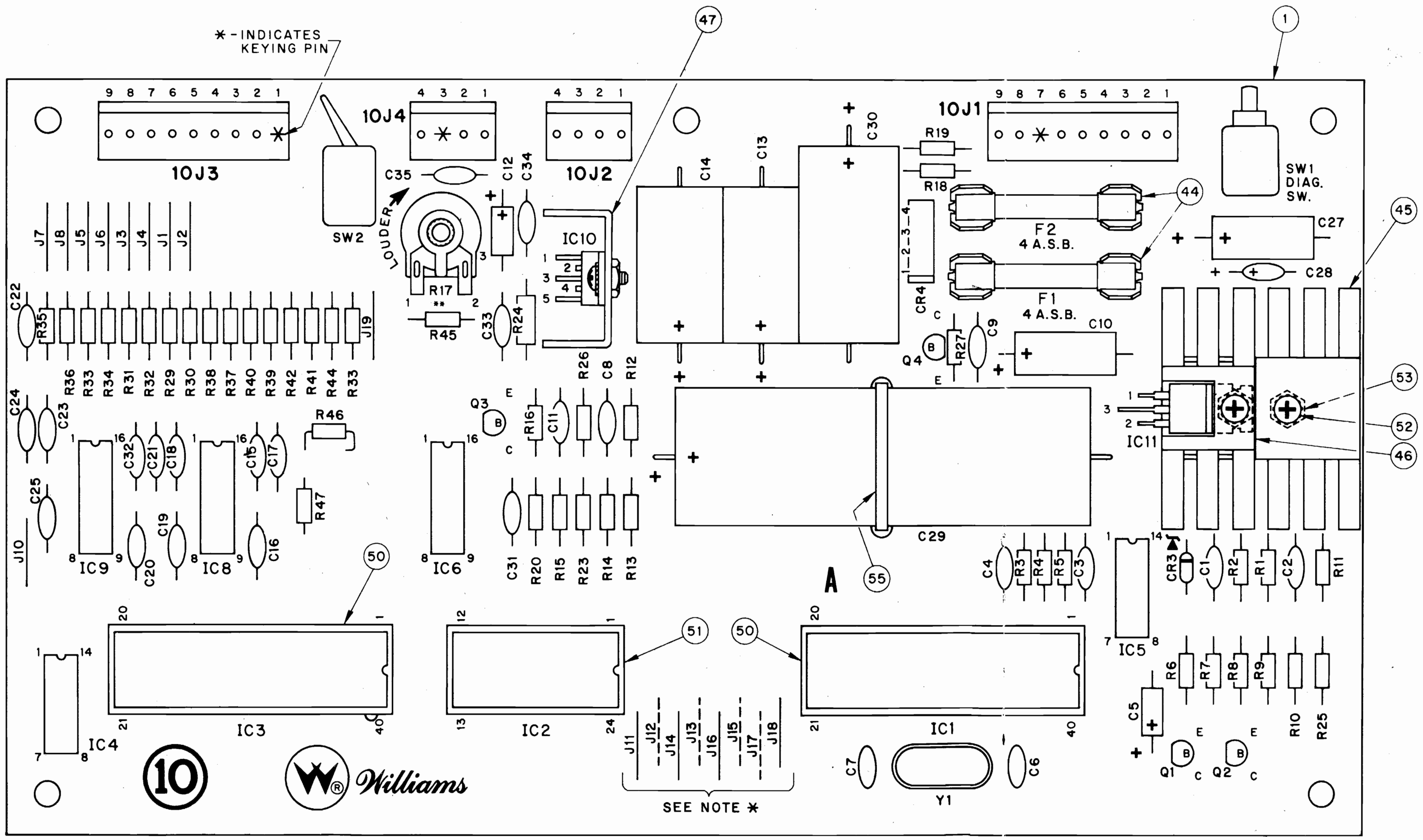


BILL OF MATERIALS			
ITEM	PART Nº	DESCRIPTION	QTY.
1	11-580	POWER SUPPLY MTG. BD.	1
2	01-7001	POWER SUPPLY GND PLATE	1
3	01-7002	POWER SUPPLY SUPPORT BRKT.	2
4	D-8359	POWER SUPPLY BOARD	1
5	C8529	VIDEO TRANSFORMER ASSY	1
6	B-6448-1	FUSE MOUNT ASS'Y.	1
7	5731-08633-00	LINE FUSE 3AMP 115/V	1
8	5102-08895-00	LINE FILTER 5A	1
9	01-6948–	OUTLET MTG BRACKET	1
10	03-6048-6	CABLE CLAMP–3/8	2
11	SEE NOTE #2	LINE CORD	1
12	4006-01018-04	M.S. #6-32 × 1/4 P-RH	4
13	4108-01022-08	SMS #8-32 × 1/2 P-RWH-A	13
14	5851-09184-00	3WIRE SNAP-IN OUTLET	1
15	SEE NOTE #1	VARISTOR	1
16	4408-01117-00	NUT 8-32 HEX	4
17	20-9223-3	6INCH BRAIDED GROUND WIRE	1
18	20-9256	1 INCH SLEEVING INSULATION	2
19	4703-00008-00	NO#8 EXTERNAL LOCK WASHER	4
21	5825-06523-00	TERMINAL LUG	1
22	5852-09575-00	BLACK-18"AWG JUMPER WIRE-2.5"L.	1
23	4008-01005-22	MS. 8-32 × 1 3/8 P-PH	4

NOTES:

1. FOR 115V.A.C., 130V. VARISTOR # 5017-09044 IS USED.
   FOR 230V.A.C., A 275V VARISTOR # 5017-09063 IS USED.
2. LINE CORD PART NUMBERS:
   - 5850-06206-00 12 FT. EUROPE
   - 5850-08728-00 U.S. DOM.
   - 5850-08737-00 AUS.
   - 5850-08743-00 U.S.L.A.
   - 5850-09128-00 12 FT. FRANCE
   - 5850-09131-00 AWG 18-12 JAPAN

D8373 Power Panel Assembly Drawing



*** NOTE:**

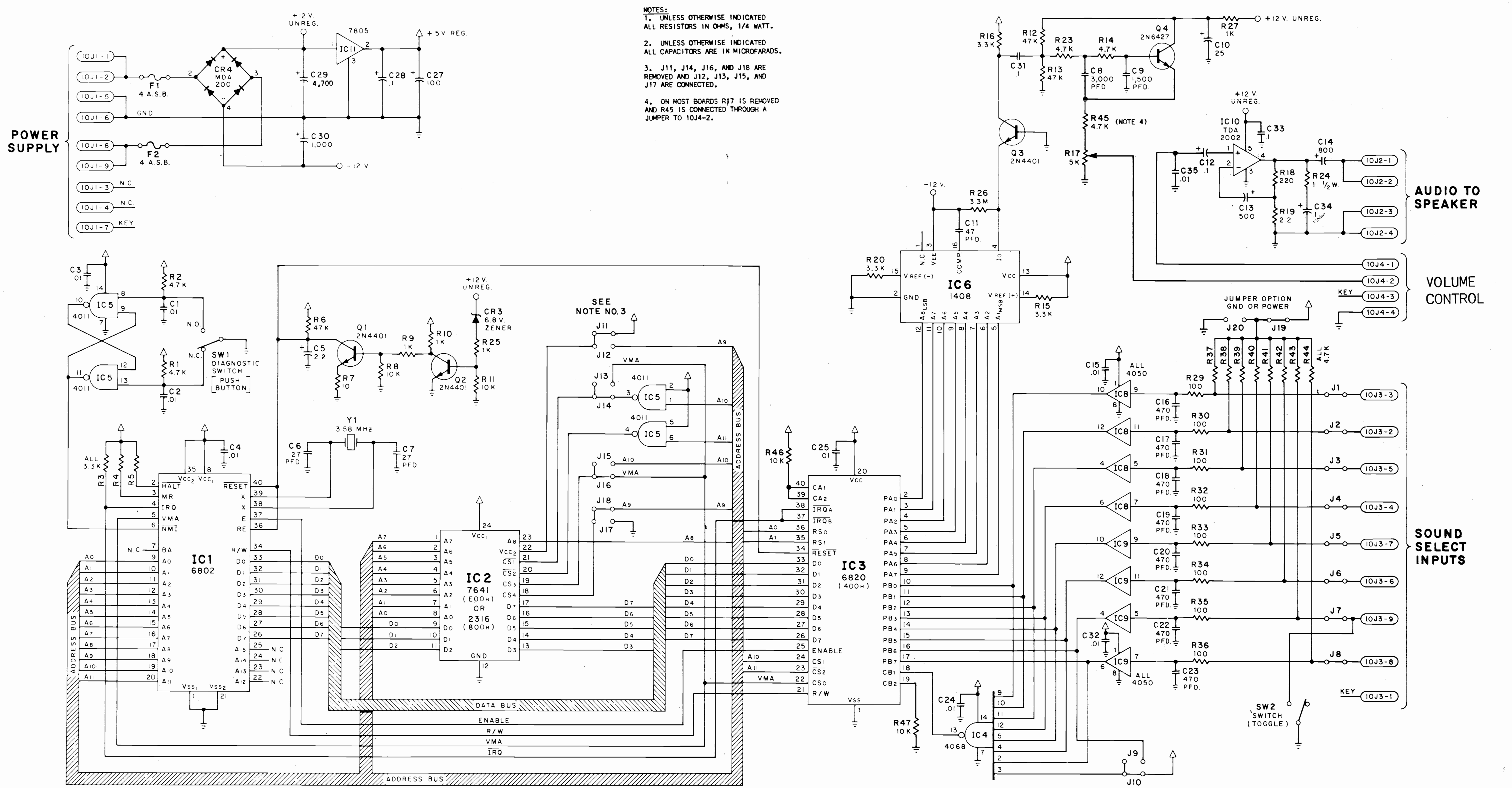
JUMPERS SHOWN WITH SOLID LINES CONNECTED FOR PROM OPERATION. THOSE SHOWN WITH DASHED LINES CONNECTED FOR ROM OPERATION.

BILL OF MATERIAL

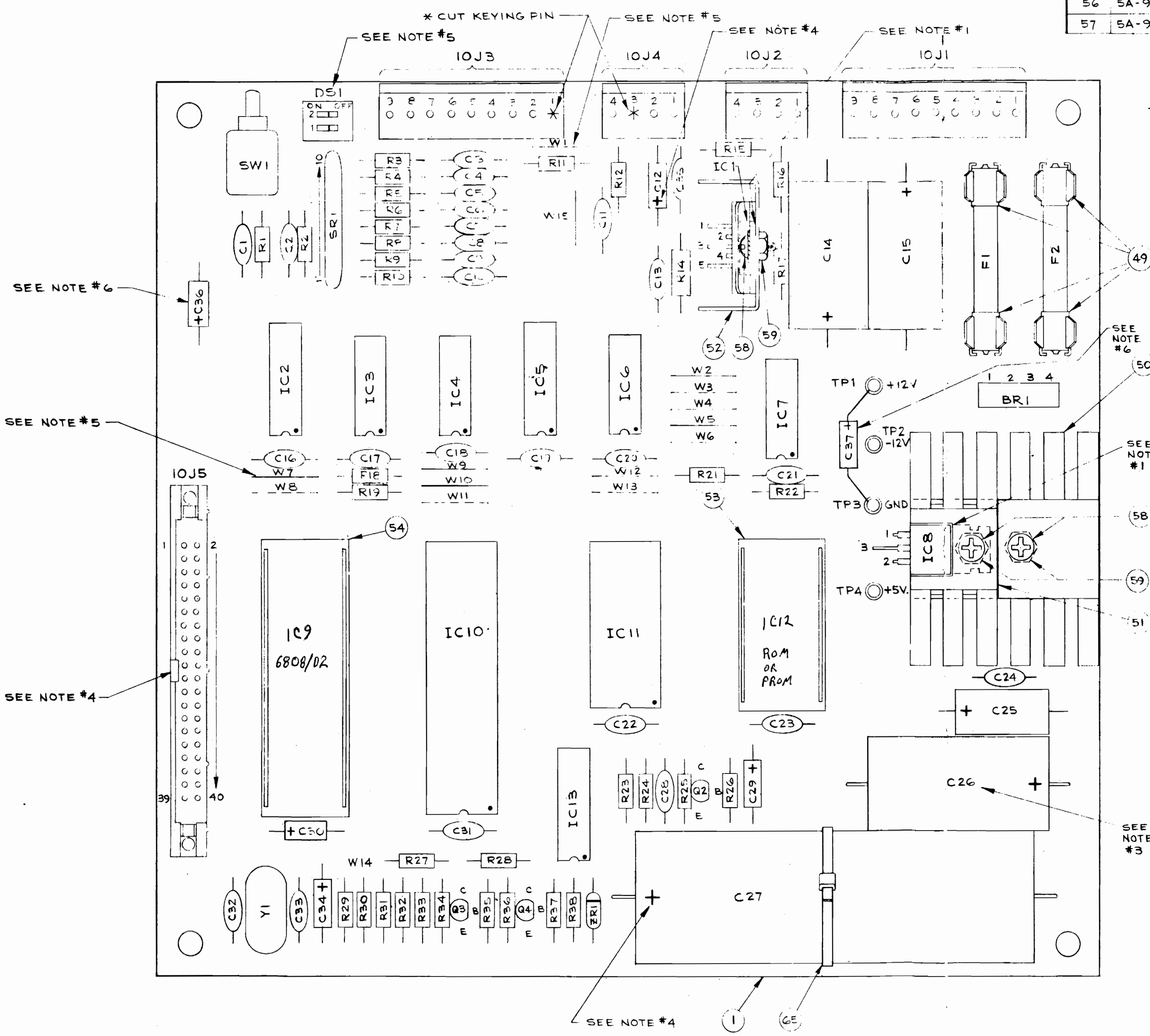
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-137		BARE P.C. BOARD	1
2	5A-8972	IC3	MC6820 PIA	1
3	5A-9154	IC4	4068 8 INPUT NAND GATE	1
4	5A-9155	IC5	4011 QUAD 2 INPUT NAND GATE	1
5	5A-9152	IC6	MC1408 D/A CONVERTER	1
6	5A-9153	IC8, IC9	4050 BUFFER	2
7	5A-9156	IC10	TDA2002V AUDIO AMPLIFIER	1
8	5A-9157	IC11	7805 5 VOLT REG. W/TO220 CASE	1
9	5C-8938	Q1, Q2, Q3	2N4401 NPN TRANSISTOR	3
10	5A-8976	Q4	2N6427 NPN TRANSISTOR	1
11	5A-9018	CR3	1N5996 6.8 V ZENER DIODE	1
12	5A-9158	CR4	MDA200/3N253 BRIDGE RECTIFIER	1
13	5B-8991	R1, R2, R14, R23, R37 THRU R45	RESISTOR, FC, 4.7 K OHM 10% 1/4 W	13
14	5B-8983	R3, R4, R5, R15, R16, R20	RESISTOR, FC, 3.3 K OHM 10% 1/4 W	6
15	5A-8984	R9, R10, R25, R27	RESISTOR, FC, 1K OHM 10% 1/4 W	5
16	5B-9039	R7	RESISTOR, FC, 10 OHM 10% 1/4 W	1
17	5B-8817	R8, R11, R46, R47	RESISTOR, FC, 10 K OHM 10% 1/4 W	4
18	5B-9035	R6, R12, R13	RESISTOR, FC, 47 K OHM 10% 1/4 W	3
19	5A-9160	R18	RESISTOR, FC, 220 OHM 10% 1/4 W	1
20	5A-9161	R19	RESISTOR, FC, 2.2 OHM 10% 1/4 W	1
21	5A-9179	R26	RESISTOR, FC, 3.3 M OHM 10% 1/4 W	1
22	5B-9036	R29 THRU R36	RESISTOR, FC, 100 OHM 10% 1/4 W	8
23	5A-9181	R24	RESISTOR, FC, 1 OHM 10% 1/2 W	1
24	5A-9376	C29	CAPACITOR, ELECTROLYTIC, 14,700 MFD. 16 V.	1
25	5A-8986	C27	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V.	1
26	5A-8893	C30	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V.	1
27	5A-9164 5A-9164-1	C13	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V.	1
28	5A-9165 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V.	1
29	5A-9168 5A-9168-1	C10	CAPACITOR, ELECTROLYTIC, 25 MFD. 20 V. OR 33 MFD. 16 V.	1
30	5A-9031	C12	CAPACITOR, TANTALUM, 1 MFD. 25 V.	1
31	5A-9163	C5	CAPACITOR, TANTALUM, 2.2 MFD. 15 V.	1
32	5A-8980	C1 THRU C4, C15, C24, C25, C32, C35	CAPACITOR, CERAMIC, .01 MFD. 50 V.	9
33	5A-8996	C28, C31, C33, C34	CAPACITOR, CERAMIC, .1 MFD. 50 V.	4
34	5A-9169	C6, C7	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V.	2
35	5A-9065	C16 THRU C23	CAPACITOR, CERAMIC DISC, 470 PFD. 50 V.	8
36	5A-9166	C9	CAPACITOR, CERAMIC DISC, .0015 MFD. 1K V.	1
37	5A-9167	C8	CAPACITOR, CERAMIC DISC, .003 MFD. 1K V.	1
38	5A-9180	C11	CAPACITOR, CERAMIC DISC, 47 PFD. 1K V.	1
**39	5A-9185	R17	POTENTIOMETER, 5K OHM	1
40	5A-9020	Y1	CRYSTAL, 3.58 MHZ.	1
41	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
42	5A-9171	SW2	TOGGLE SWITCH SPDT	1
43	5A-6314	F1, F2	4 AMP. SLOW BLOW FUSE	2
44	5A-9178		FUSEHOLDER	4
45	5A-9172		HEAT SINK THERMALLOY #6072B	1
46	5A-9173		HEAT SINK THERMALLOY #6071B	1
47	5A-9199		HEAT SINK THERMALLOY #6030	1
48	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
49	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
50	5A-8985		40 PIN SOCKET	2
51	5A-9004		24 PIN SOCKET	1
52			6-32 X 3/8" BINDER HEAD SCREW	2
53			6-32 HEX. NUT	2
54		J1 THRU J8, J10, THRU J19	WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	18
55	3A-7520-1		TIE WRAP	1
56	5A-9150	IC1	MC6802 MICROPROCESSOR	1
57	5A-9264	IC2	VIDEO SOUND ROM 1	1

**ON MOST BOARDS, R17 IS REMOVED AND A JUMPER CONNECTED BETWEEN TERMINALS 1 AND 2.

D8121 Sound Board Assembly Drawing



D8121 Sound Board Logic Diagram



NOTES:

1. USE THERMAL COMPOUND BETWEEN IC8 AND HEAT SINK.
2. CAUTION: AVOID STATIC DISCHARGE DAMAGE TO MOS LOGIC.
3. SYMBOLS SHOWN ON COMPONENTS ARE FOR REFERENCE ONLY. DO NOT SCREEN OR STAMP.
4. OBSERVE INDEX MARK OF ALL INTEGRATED CIRCUITS, DIODES D1, D2, AND ZR1. CAPACITORS C12, C14, C15, C25, C26, C27, CONNECTORS 10J1, 10J2, 10J4, 10J3, 10J5, POSITION OF TRANSISTORS Q1, Q2, Q3, Q4.
5. DS1 - 1 SELECTS SOUNDS/NOTES
   2 SELECTS SPEECH/NO SPEECH (W9/W4)

   W1 - SPEECH MODULE STATUS
   IN - SPEECH MODULE NOT ATTACHED
   OUT- SPEECH MODULE ATTACHED

   W14 - MPU INTERNAL RAM ENABLE

   W7 & W8-MEMORY MAP CONTROL

   W12 & W13 - PB7 STATUS CONTROL (W13 NEVER USED)

   W4 & W9 - PB5 STATUS CONTROL
6. SOLDERED ON TOP OF BOARD

INSTAL THESE JUMPERS FOR FOLLOWING GAMES:

W15, W8, W12, W4, W1, W3, W6, W11 FOR:

- WORLD CUP
- DISCO FEVER
- CONTACT
- POKERINO
- PHOENIX
- ARISTOCRAT SHUFFLE
- POMPELI SHUFFLE
- KING TUT SHUFFLE
- TAURUS SHUFFLE

} SOUND ROM 1

W15, W8, W12, W4, W1, W2, W5, W10, FOR:

- FLASH
- STELLAR WARS
- TRI ZONE
- TIME WARP

} SOUND ROM 1 5A-9198

W7, W15, W9, W1, (SEE NOTE #5) W2, W5, W10 FOR:

GORGAR ; SOUND ROM 2 - 5T-4960

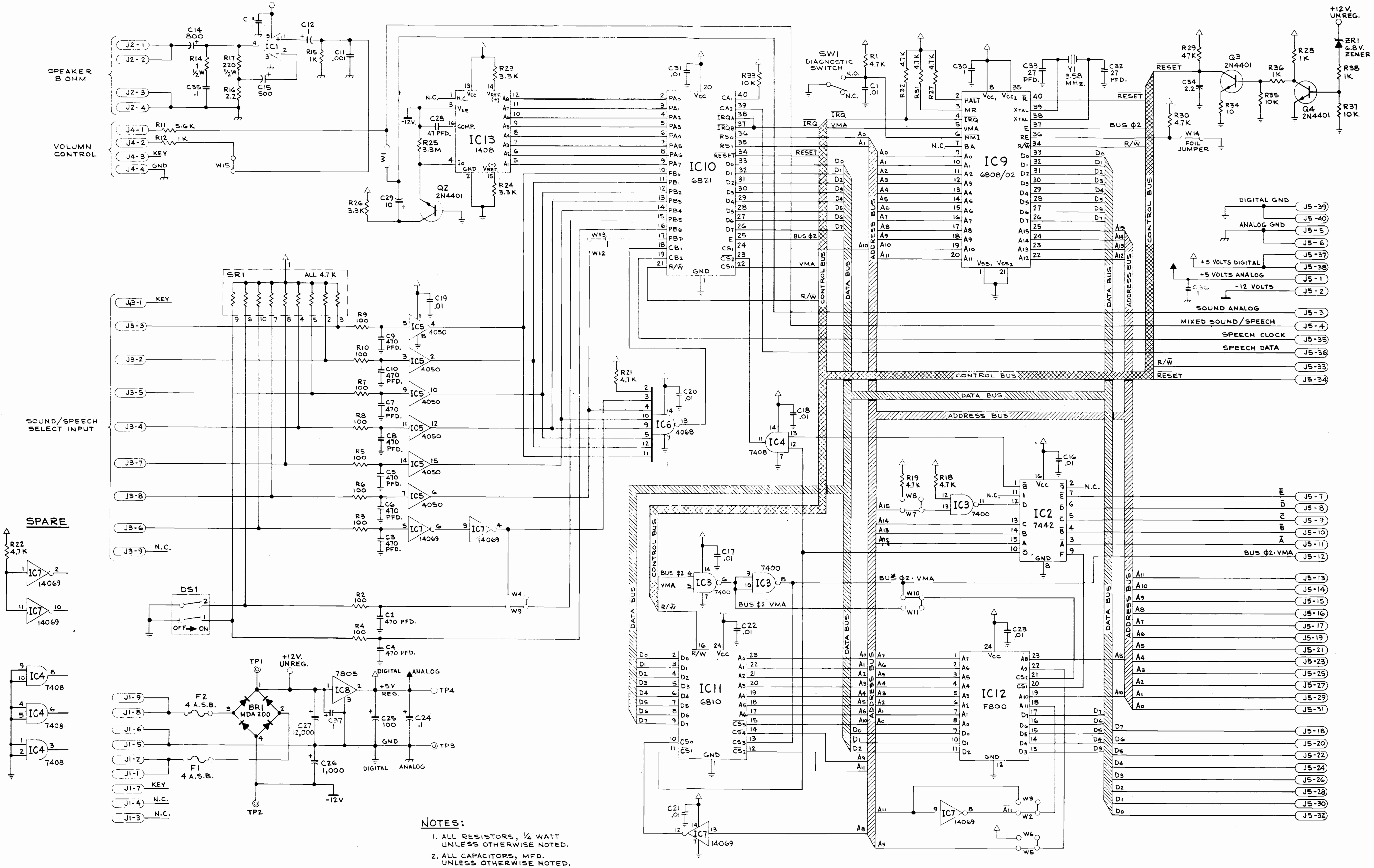
IC 12 SELECTION STRAPPING:

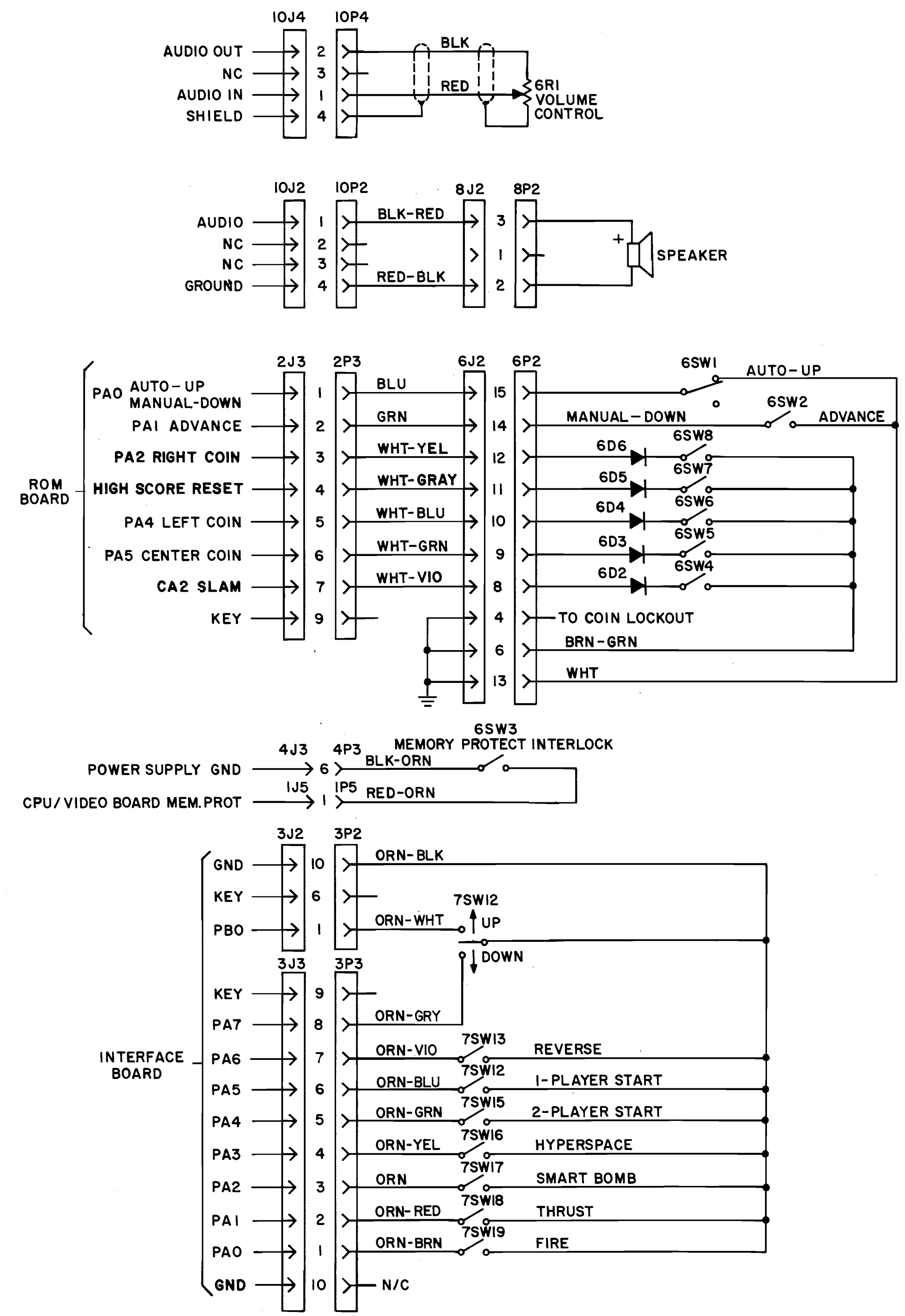
(2K x 8)	(4K x 8)	(512 x 8)
W2	W3	W3
W5 IN	W5 IN	W6 IN
W..	W..	W11

BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1C-2001-146-3		BARE P.C. BOARD	1
2	5A-9156	IC1	TDA2002 V AUDIO AMPLIFIER	1
3	5A-9012	IC2	7442 BCD-DEC DECODER	1
4	5A-9073	IC3	7400 QUAD 2 INPUT NAND	1
5	5A-8973	IC4	7408 QUAD 2 INP. AND GATE	1
6	5A-9153	IC5	4050 BUFFER	1
7	5A-9154	IC6	4068 8 INPUT NAND GATE	1
8	5A-8971	IC7	14069 HEX INVERTER	1
9	5A-9157	IC8	7805 5 VOLT REG. W/TO220 CASE	1
10	5A-8972	IC10	6821 P.I.A.	1
11	5A-9003	IC11	6810 RAM	1
12	5A-9152	IC13	1408 D/A CONVERTER	1
13	5C-8938	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14				
15	5A-9018	ZR1	1N5996 6.8V. ZENER DIODE	1
16				
17	5A-9158 OR 5A-9357	BR1	MDA 200/3N253 BRIDGE RECTIFIER	1
18	5A-9020	Y1	3.58 MHz CRYSTAL	1
19	5B-8991	R1, R18, R19, R21, R22, R27, R30, R31, R32	RESISTOR, FC, 4.7K OHM 5% 1/4 WATT	9
20	5B-9036	R2 THRU R10	RESISTOR, FC, 100 OHM 10% 1/4 WATT	9
21	5A-8984	R12, , R15, R28, R36, R38	RESISTOR, FC, 1K OHM 10% 1/4 WATT	5
22	5A-9181	R14	RESISTOR, FC, 1 OHM 10% 1/2 WATT	1
23	5A-9161	R16	RESISTOR, FC, 2.2 OHM 10% 1/4 WATT	1
24	5A-9361	R17	RESISTOR, FC, 220 OHM 10% 1/2 WATT	1
25				
26	5B-8983	R23, R24, R26	RESISTOR, FC, 3.3K OHM 10% 1/4 WATT	3
27	5A-9179	R25	RESISTOR, FC, 3.3 M OHM 10% 1/4 WATT	1
28	5A-9359	R29	RESISTOR, FC, 47 K OHM 5% 1/4 WATT	1
29	5B-8817	R33, R35, R37	RESISTOR, FC, 10 K OHM 10% 1/4 WATT	3
30	5B-9039	R34	RESISTOR, FC, 10 OHM 10% 1/4 WATT	1
31	5A-8980	C1, C16 THRU C23 C31	CAPACITOR, CERAMIC, .01 MFD. 50 V. ±20%	11
32	5A-9065	C2 THRU C10	CAPACITOR, CERAMIC, 470 PFD. 50 V. ±20%	9
33	5A-9345	C11	CAPACITOR, CERAMIC, .001 MFD. 20% 100 V.	1
34	5A-9365	C12, C30, C36	CAPACITOR, ELECTROLYTIC 1 MFD. 63 V. -10/+ 50%	3
35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	3
36	5A-9165 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
37	5A-9164 5A-9164-1	C15	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V. ±20%	1
38	5A-8986	C25	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V. ±20%	1
39	5A-8893	C26,	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V. ±20%	1
40	5A-9046	C27	CAPACITOR, ELECTROLYTIC, 12,000 MFD. 16 V. ±20%	1
41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1K V. ±20%	1
42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25 V. LOW LEAK ±20%	1
43	5A-9169	C32, C33	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V. ±10%	2
44	5A-9163	C34	CAPACITOR, TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	5A-9031	C37	CAPACITOR, TANTALUM, 1 MFD. 25V. ±20%	1
46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	5A-9330	DS1	2 STD. DIP SWITCH	1
48	5A 6314	F1, F2	4 AMP SLOW BLOW FUSE	2
49	5A-9178		FUSE HOLDER	4
50	5A-9172		HEAT SINK THERMALLOY #6072B	1
51	5A-9173		HEAT SINK THERMALLOY #6071B	1
52	5A-9199		HEAT SINK THERMALLOY #6030	1
53	5A-9004		24 PIN SOCKET	1
54	5A-8985		40 PIN SOCKET	1
55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
57	5A-9349	10J5	40 PIN RIBBON HEADER	1
58			6-32 x 3/8" BINDER HEAD SCREW	3
59			6-32 HEX NUT	3
60		W1, W2, W5, W7, W9, W10, W15	WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	7
61	5A-9248	TP1 THR TP4	TERMINAL # 1502-1	4
62	5A-9363	R11	RESISTOR, FC, 5.6 K OHM 5% 1/4 WATT	1
64	5A-9362	SR1	RESISTOR, 4.7 K OHM 10 PIN SIP	1
65	3A-7520-1		TIE WRAP	1

TOLERANCES		QTY.	ASSEMBLE ON
UNLESS OTHERWISE SPECIFIED	WILLIAMS ELECTRONICS, INC. SUBSIDIARY OF THE SEEBURG CORP. 3401 N. CALIFORNIA CHICAGO, ILL. 60618 267-2240		
FRACTIONAL ±1/64" DECIMAL ±.005" HOLE DIA. +.002 -.000" ANGULAR ±1/2° CONCENTRICITIES T.I.R. .002" SCREW THREADS CLASS 2	NAME SOUND BOARD SUB-ASSEM		
	MATERIAL	HEAT TREATMENT	FINISH
DWN. RGH	DATE 9-23-79	APP'D. 10/19/79	SCALE 2:1
			D-8223


SPEAKER 8 OHM
VOLUMN CONTROL
SOUND/SPEECH SELECT INPUT
SPARE
DS1
OFF ON
SW1 DIAGNOSTIC SWITCH
IC1
IC2 7442
IC3 7400
IC4 7408
IC5 4050
IC6 4068
IC7 14069
IC8 7805
IC9 6808/02
IC10 6821
IC11 6810
IC12 F800
IC13 1408
Q2 2N4401
Q3 2N4401
Q4 2N4401
ZR1 6.8V. ZENER
Y1 3.58 MHz.
BR1 MDA 200
F1 4 A.S.B.
F2 4 A.S.B.
+12V. UNREG.
-12V
+5V REG.
DIGITAL
ANALOG
TP1
TP2
TP3
TP4
CONTROL BUS
DATA BUS
ADDRESS BUS
RESET
BUS Φ2
BUS Φ2 · VMA
R/W
IRQ
VMA
DIGITAL GND
ANALOG GND
+5 VOLTS DIGITAL
+5 VOLTS ANALOG
-12 VOLTS
SOUND ANALOG
MIXED SOUND/SPEECH
SPEECH CLOCK
SPEECH DATA
FOIL JUMPER
SR1 ALL 4.7 K
NOTES:
1. ALL RESISTORS, 1/4 WATT UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS, MFD. UNLESS OTHERWISE NOTED.



Cabinet Wiring Diagram